DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM
WATER QUALITY MONITORING AND ASSESSMENT SECTION
WATERSHED INFORMATION SHEET

Chariton River Basin-10280201, 10280202

Basin Description

The Chariton River originates in southern Iowa and flows almost due south through north central Missouri to its confluence with the Missouri River. The major tributaries include Shoal, Blackbird and Brush creeks and Mussel Fork. The largest reservoirs in the Missouri portion of the basin are Lake Thunderhead (1,015 acres) near Unionville and Forest Lake in Thousand Hills State Park (573 acres). These two reservoirs and five smaller ones supply much of the public drinking water in this basin.

Average annual rainfall ranges from 37 inches in the northern part of the basin to 39 inches in the south. Streamflow statistics for the Chariton River are shown in Table 1. Flows are somewhat controlled by Rathbun dam in Iowa.

Table 1. Streamflow Statistics for Chariton River Basin

Stream/Location	Watershed Area (sq.mi.)	Period Of Record	Flow (cfs)				
			90th Percentile *	Mean	Median **	10th Percentile ***	7Q10 Low Flow+
Chariton R. @ Livonia	864	1974-2004	1,540	637	287	32	
Chariton R. @ Novinger	1,370	1970-2004	2,300	1,072	472	40	
Chariton R. @ Prairie Hill	1,870	1929-2004	3,060	1,243	352	40	8.6
Mussel Fork nr. Musselfork	267	1948-51, 1962-90, 2002-04	500	232	28	2.5	

* Flow is less than this amount 90 percent of the time
**Flow is less than this amount 50 percent of the time
***Flow is less than this amount 10 percent of the time
+ The lowest average 7 consecutive day flow that occurs with a recurrence interval of 10 years.

The Chariton River basin lies with the Dissected Till Plains physiographic province. The land is a mixture of hills and plains with the northern portion of the basin having more hills and woods than any other portion of the plains region in Missouri. Fifty-six percent of the land is pasture and hayfields, 23 percent is forest and 20 percent row crops.

Except for limited areas where streams may have incised Pennsylvanian aged rock, the surface of the basin is glacial till overlain by loess. Glacial till is a mostly unsorted mixture of clay, sand, gravel and rock debris created and pushed southward into Missouri by the great glacial ice sheets. Loess are windblown silt deposits. Depth of the till is highly variable but is generally less than 200 feet. Loess deposits are generally 4-8 feet

in depth. Cyclical (repetitive) deposits of sandstone, siltstone, shale, limestone and coal of Pennsylvanian age underlie these glacial deposits.

The presence of the clayey till and the underlying shale and coal beds insure that there is very little movement of water to the subsurface. Most water movement in the basin is through the surface stream network. Water that reaches the subsurface will resurface locally when a stream valley incises a confining aquatard (an impermeable layer). Only seven small springs are known within the basin. None of the estimated flows from these springs exceeds 10 gallons per minute and they probably cease flowing in dry weather. Since very little water infiltrates to the subsurface, streamflows can be very high during wet weather. For the same reason, base flows, streamflow sustained only by the re-emergence of groundwater into the stream, are very low during the intervening dry periods

Water Quality Concerns

Acceptable water quality is defined by Missouri's Water Quality Standards [http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf] . Streams or lakes that do not meet these standards are judged to be "impaired". They may not be fit for certain uses such as swimming, drinking water supply or protection of fish and other aquatic life. Waters are judged to be "affected" if water quality changes are less serious and state standards are not exceeded. These standards also list more than 3,600 classified streams and more than 400 classified lakes in the state. A classified stream is one that is either a permanently flowing stream or one that may stop flowing in dry weather but still maintains large pools of water that support aquatic life. Unclassified streams are small tributaries to classified streams. They typically have flowing water only during wet weather, and are dry for the remainder of the year.

Water Quality in Prairie Streams
http://www.dnr.mo.gov/env/wpp/watersheds/info/wq-prairie-str.pdf

Aquatic Habitat in Prairie Streams
http://www.dnr.mo.gov/env/wpp/watersheds/info/aquatic-hab-prairie-str.pdf

Point Source Pollution

Point source pollution is a discharge of wastewater from a single location such as a wastewater treatment plant. Wastewater treatment plants can serve industries, small businesses, subdivisions, mobile home parks, apartment complexes, or entire cities. Wastewater from residential sources such as subdivisions, apartments and mobile home parks is often referred to as "domestic wastewater." It primarily contains treated human wastes, food wastes and detergents. The primary pollutants of concern in domestic wastewater are the amount of organic matter, which is commonly reported as Biological Oxygen Demand (BOD), suspended solids, and ammonia. Industrial and commercial wastewater can be more complex and may contain, in addition to domestic wastes, heavy

metals or man-made organic chemicals that can be potentially toxic. Discharges from most municipal wastewater treatment plants usually are a mixture of domestic and industrial/commercial wastewater. Most wastewater plant discharges are also typically high in nitrogen and phosphorus, two elements that act as fertilizers and can cause excessive algae growth in waters receiving these discharges.

There are 14 permitted domestic or industrial/commercial wastewater point sources that discharge a combined 0.60 million gallons per day (mgd) into the waters of the Chariton River basin. There are 426 miles of classified streams in the basin, of which four miles (one percent) are known to be affected or impaired by these point source discharges. Point source discharges are also known to affect or impair 5.1 miles of unclassified streams in the basin. Discharges that affect or impair more than 0.5 miles of stream include Unionville South and Green City.

Wastewater Treatment
http://www.dnr.mo.gov/env/wpp/watersheds/info/wastewater-treatment.pdf

Nonpoint Source Pollution

Nonpoint source pollution occurs when pollutants enter bodies of water at points that are not well-defined and stable. Examples include the erosion of sediments or the entrance of polluted surface runoff or groundwater into lakes and streams. Locations of nonpoint source pollution are often widely dispersed and are difficult to identify or control. In the Chariton River basin, the most serious nonpoint problem is degradation of aquatic habitat. A total of 400 miles (94 percent) of classified streams in the basin are considered to have degraded aquatic habitat. The lack of infiltration of rainfall, when combined with local soil tillage and other land uses, leads to a large amount of surface runoff during wet weather. This contributes to soil erosion and high levels of sediment deposition in streams. The quality of aquatic habitat is further impaired by removal of wooded riparian vegetation, and by the channelization, or straightening, of streams. Channelization has occurred in 128 miles (30 percent) of streams in the basin.

Storm water runoff in the Midwest can carry significant amounts of fertilizers, animal wastes, and pesticides into streams. Proper manure management is especially important in this basin due to the presence of two very large hog farms that land apply large amounts of liquid hog manure.

Atrazine is an agricultural herbicide used on corn and grain sorghum that is commonly found in stormwater. Missouri's water quality standards allow no more than 3.0 ug/l Atrazine in drinking water reservoirs as a long-term average. There are seven reservoirs in the Chariton River basin that serve as drinking water supplies. None of these reservoirs have average Atrazine levels in excess of state standards. Average Atrazine levels for these reservoirs are given in Table 2. Drinking water reservoirs throughout northern and western Missouri are also monitored for several other common agricultural

herbicides. Results of this monitoring over many years indicates that the only other herbicide that may be a human health concern in drinking water reservoirs is Cyanazine. None of the drinking water reservoirs in this basin exceed health advisory levels for Cyanazine. Federal regulations require the end of all Cyanazine use in 2002.

Table 2. Long Term Average Atrazine Levels in Drinking Water Reservoirs in the Chariton River basin.

Reservoir	Water Supply	Average Atrazine in the Reservoir (ug/l)
Lake Mahoney	Unionville	1.52
Old Marceline Lake	Marceline	1.11
Lake Thunderhead	Unionville	1.14
Bucklin Lake	Bucklin	0.74
Green City Reservoir	Green City	0.59
Hazel Creek Lake	Kirksville	0.05
Forest Lake	Kirksville	0.00

Levels of Atrazine in finished drinking water supplies may be significantly lower than the amounts found in the reservoirs if the drinking water plants take measures to reduce Atrazine during the water treatment process.

Groundwater can also be affected by nonpoint source pollution. In northern and western Missouri, some public water supplies and many private water supplies come from groundwater. While public groundwater supplies are routinely tested and protected, many private wells are not. Studies of water quality of private wells in northern and western Missouri show that about one third of wells exceed the drinking water standard for nitrate. And about two percent exceed drinking water standards for pesticides. This contamination is often caused by local land use practices or surface contamination of the wellhead and does not represent widespread contamination of the underground aquifer. Deeper aquifers are protected from surface contamination by impermeable strata.

During warm weather when stream flows are low, livestock tend to gather in and around streams. The wastes they leave in the water contribute to nuisance algae growths, low levels of dissolved oxygen and elevated levels of ammonia and bacteria.

The effect of past coal mining has resulted in less serious nonpoint source problems. Abandoned coal mined lands in the Blackbird, Shoal and Sandy creek watersheds have resulted in increased levels of dissolved minerals, primarily sulfate, in 11 miles (2.5 percent) of classified stream and 6.5 miles of unclassified stream. Small abandoned coal waste piles affect 0.1 miles of classified stream and 0.8 miles of unclassified streams in western Adair County.

Water Quality Management

The department achieves water quality management of point source pollutants through the issuance and enforcement of wastewater discharge permits. These permits limit the amount of pollutants that can be discharged. All point source wastewater dischargers must obtain a permit and adhere to its discharge limitations. All permits require at least a level of treatment equal to national wastewater treatment standards. In situations where these national treatment standards are not adequate to protect the streams or lakes receiving these wastewater discharges, stricter permit limits that do protect these waters are required. The permits require regular monitoring and reporting of discharge quality. The department also conducts regular inspection of wastewater treatment facilities and receiving waters.

Nonpoint source pollution is addressed through the state's nonpoint source management plan. This plan is a cooperative program between the Department of Natural Resources and other federal, state and local government agencies or organizations, local landowners and other interested citizens. The plan emphasizes addressing problems at the watershed level through the use of management practices that control nonpoint pollution. The most commonly supported practices are those that control soil erosion on agricultural and urban lands, improve quality and quantity of forage on grazing lands, protect riparian zones, and those that control runoff of animal manures, fertilizers and pesticides. The state nonpoint source management plan is a voluntary program that provides funds to help defray the cost of adopting management practices.

A portion of state sales tax money has been earmarked for soil and water conservation. These funds are administered by the department and have resulted in seven nonpoint source watershed projects in the Chariton River basin. These projects treated nearly 15,000 acres of land, comprising about 1.5 percent of the entire basin.

Table 3. Nonpoint Source Watershed Projects in the Chariton River Basin

Watershed Name	County	Project Date	Watershed Size (Acres)	Acres Treated	Percent of Watershed Treated
Little Hazel Creek	Adair	1991-95	5,240	2,298	44
Unionville City Reservoir	Putnam	1992-96	1,839	1,002	54
Jones Branch	Chariton	1995-99	7,909	2,910	37
Turkey Creek	Putnam	1995-99	7,880	2,419	31
Bee Branch	Chariton	1994-99	20,339	6,155	30
Blackbird Creek	Putnam	2002-09			
Mussel Fork	Chariton	2004-2011			

The Missouri Department of Natural Resources monitors water chemistry and aquatic invertebrate communities at many locations in Missouri. The department also tracks the quality of domestic, industrial and storm water discharges. These monitoring activities

provide information on water quality problems, such as their specific location, pollutants, sources and possible solutions. This information guides the management activities the department takes to protect water quality in Missouri.

Web links

US Geological Survey
http://mo.water.usgs.gov/

Kansas City District Corps of Engineers
http://www.nwk.usace.army.mil/

Missouri Department of Conservation
http://www.mdc.mo.gov/fish/watershed/chariton/060cotxt.htm

US Environmental Protection Agency
http://www.epa.gov/region7/water/index.htm